Cotton Agricultural Chemical Use and Farming Practices in 1989

An Overview of Survey Results

Research
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In this report. *A 1989 U.S. Department of Agriculture (USDA) survey of cotton producers reveals that 82 percent of cotton acreage was fertilized with nitrogen, 93 percent was treated with herbicides, and 67 percent was treated with insecticides. The survey also found cotton producers were using nonchemical pest management practices, including cultivation on 97 percent of planted acreage and pest scouting programs on 56 percent of planted acreage. Soil conservation was not as widely adopted, partly due to climate and topography in cotton-growing regions. About 60 percent of the surveyed acreage contained a well on the operation, but not many respondents knew if the well contained pesticides or nitrates.*

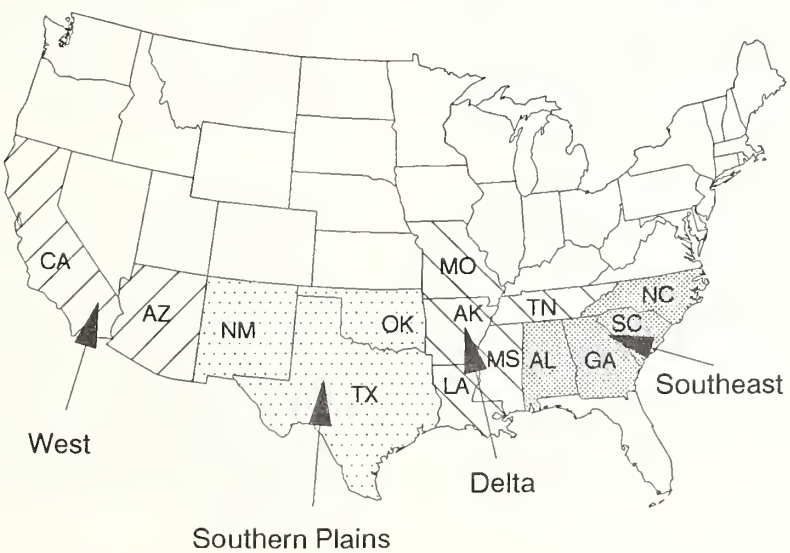
The USDA conducted a survey of cotton producers in 14 southern and western States in the fall of 1989. The survey is an initial contribution to the President's Water Quality Initiative. Information from the survey provides a comprehensive accounting of field applications of pesticides and fertilizers on the 1989 cotton crop. The survey also provided an opportunity to test data collection procedures and begin to accumulate chemical use data that will cover all major field crops, vegetables, and fruits by 1993.

The survey accounted for cotton production practices on 10.5 million acres (fig. 1). This report gives a brief overview of survey results, providing summary information on pesticide and fertilizer use, pest management practices, soil conservation and tillage practices, water use, and characteristics of cotton producers.

Additional analyses, including details of chemical types and quantities and potential water quality implications of cotton production, are underway in the USDA's Economic Research Service. Some findings are preliminary and may change with further analysis.

Figure 1

Regions examined by the 1989 cotton water quality survey



Cotton Production and Water Quality: An Overview

Cotton is an important commercial crop, but production practices can affect the quality of our surface and ground water resources. Not all cotton cropland has the same potential for water quality problems.

Cotton has been a major U.S. cash crop for nearly 200 years. In 1988, cotton was the fifth most valuable field crop (production of $4.8 billion) after corn ($13 billion), hay ($10.6 billion), soybeans ($7.8 billion), and wheat ($6.6 billion). Approximately 12 million acres were harvested in 1988, or about 4 percent of harvested U.S. cropland devoted to major field crops. Production in 1989 in the 14 States covered by the survey (Alabama, Arkansas, Arizona, California, Georgia, Louisiana, Missouri, Mississippi, North Carolina, New Mexico, Oklahoma, South Carolina, Tennessee, and Texas) was estimated to be 12.2 million bales on 9.5 million harvested acres.

Water resources are potentially affected by cotton production in many ways. Cotton production is very chemical intensive: production includes the use of fertilizers, insecticides, defoliants, and herbicides. Fertilizers, such as nitrogen, phosphate, and potash, are applied at the time the seed bed is prepared to enhance plant yield and quality. Herbicides are applied to control weeds. Insecticides are applied to control pests such as the boll weevil, the bollworm, cotton aphids, and the tobacco budworm. Defoliants are applied to aid harvest.

When agricultural chemicals are applied to cropland, one of three things happens: some residues may remain in the soil after the plant takes up the chemical, atmospheric volatilization may occur, or runoff may take place. In addition, residues may be transformed by chemical or physical processes into products that can have an adverse ecological effect. For example, nitrogen from fertilizer or animal waste may break down into ammonium and then into nitrates.

Not all cotton cropland has the same potential for water quality problems. The potential for fertilizers and pesticides to accumulate in ground or surface water depends on a combination of factors. Soil characteristics, geologic factors, soil type, tillage practices, irrigation, and rainfall all influence the likelihood that chemicals applied to cropland will leach into ground water or be washed away into lakes and streams.

The potential for chemicals and sediment to reach either ground water or surface water is also strongly influenced by the history of fertilizer and pesticide use on the farm, the method and rate of applications, the levels of chemical residue, the chemical properties of the materials applied (such as solubility in water), the tendency to adsorb onto soil particles, and the management practices the operator uses on the farm.

In order to understand the relationships between agricultural production and the resulting effects on water quality, detailed data on agricultural chemical use and production practices are needed. Information on the physical characteristics of the cropland (such as soil properties and distance to water bodies), and on surface and ground water quality is also needed to establish these linkages.

Finally, information about the socioeconomic characteristics of the farm operator are needed to understand and predict how farmers will respond to programs aimed at protecting water quality. These programs are education, technical assistance, and financial incentives designed to promote adoption of alternative farm management practices to safeguard water quality.

Concern about water quality problems related to agriculture is prompting new program efforts. The USDA and other Federal and State agencies have begun a 5-year effort to protect ground and surface water from potential contamination by agricultural chemicals and wastes. The President's Water Quality Initiative is a multiagency program to assess water quality problems from agricultural sources and to develop ways to prevent degradation of the Nation's ground and surface water.

The 1989 Cotton Water Quality Survey is the first of a series of surveys of agricultural chemical use and related production practices that will be undertaken by USDA's Economic Research Service and National Agricultural Statistics Service. Information obtained by these surveys will be used to support economic analysis of new farm management systems to protect water quality and to help develop and promote the voluntary adoption of agricultural practices that are both economically viable and environmentally sound.

Agricultural Chemical Use Surveys and the President's Water Quality Initiative

- The President's Water Quality Initiative is a multiagency program under the leadership of USDA to provide farmers, ranchers, and foresters the knowledge and technical means to respond independently and voluntarily to on- and off-farm environmental concerns and related State water quality requirements. The USDA Water Quality Program is three-pronged: education and technical assistance, research and development, and database development and evaluation.

- The 1989 Cotton Water Quality Survey is the first in a series of surveys conducted as part of the USDA database development and evaluation activities. The goal is to develop, analyze, and report timely, statistically reliable, and detailed data on farm use of pesticides, fertilizers, and related inputs.

- Future surveys will gather chemical use and farm economic data for different commodities on a continuing cycle. Cropping practice surveys will be conducted in 1990 on corn, soybeans, wheat, rice, cotton, and potatoes. Farm chemical use and economic data will be gathered every 2 years for vegetable, fruit, and nut producers. Selected area studies in specific regions of the country will be conducted to help evaluate the connections between resource characteristics, farm production practices, and water quality.

Fertilizer Use

Rates of applying nitrogen, phosphate, and potash to cotton cropland vary by region, reflecting differences in soil types, moisture conditions, and farming practices. Less fertilizer is used to grow cotton than some other major field crops.

Chemical fertilizers are an important part of the cotton production process. Nearly all cotton acreage surveyed was treated at least once with nitrogen, phosphate, or potash during the season.

Fertilizers may be applied to the cropland in many ways. The choice of application technique depends on soil type and the type of fertilizer used. The method chosen will affect the rate at which the cotton plant uses fertilizers.

About 40 percent of the surveyed acres were fertilized by broadcasting. The second-most popular way was foliar application (21 percent), followed by soil injection (19 percent) and banding or chemigation (10 percent each). Chemigation is a newer technology that mixes nutrients and pesticides in irrigation water.

Fertilizer use depends on many factors. Variability in fertilizer use among regions reflects differences in soil types, climate, drought and moisture conditions, previous crops, crop yields, and farming practices. The proportion of cotton acres treated with fertilizers of all types ranged from 65 percent in the Southern Plains to about 98 percent in the Delta and the Southeast (table 1). Application rates averaged 77 pounds per acre for nitrogen, 44 pounds per acre for phosphate, and 34 pounds per acre for potash (fig. 2).

Cotton producers use relatively less fertilizer than producers of some other major field crops. Figure 3 compares 1989 application rates for cotton production with that of other major field crops (corn, wheat, and soybeans). Corn producers apply more pounds of all three fertilizer nutrients than cotton farmers. Cotton production uses nitrogen more intensively than wheat and soybeans. It uses phosphate at about the same amount per acre as these other two crops. It uses less potash per acre than these other two crops.

Table 1--Cotton fertilized and application rates, 1989

The Southeast and the Delta had the highest shares of acres treated.

Region	Nitrogen		Phosphate		Potash	
	Share of acres treated	Application rate	Share of acres treated	Application rate	Share of acres treated	Application rate
	Percent	*Lbs/acre*	*Percent*	*Lbs/acre*	*Percent*	*Lbs/acre*
Southeast	98	81	92	52	94	75
Delta	99	93	69	48	73	63
Southern Plains	65	53	54	38	23	16
West	97	133	45	55	11	12
All regions	82	77	60	44	42	34

Figure 2

Fertilization by region and intensity of use, 1989

Nitrogen was used most intensively, especially in the West.

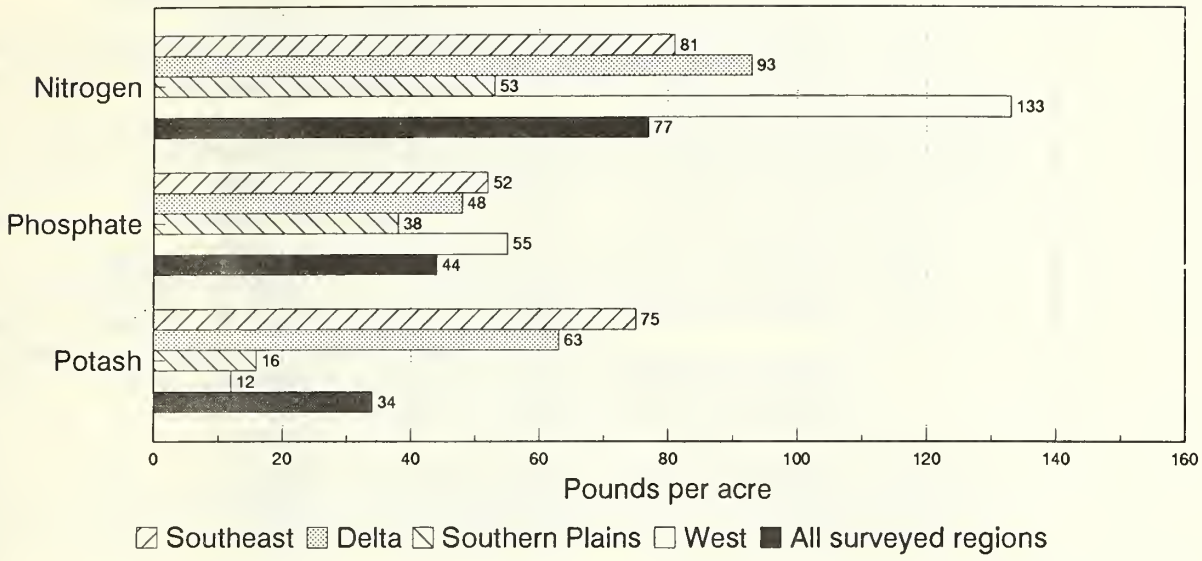
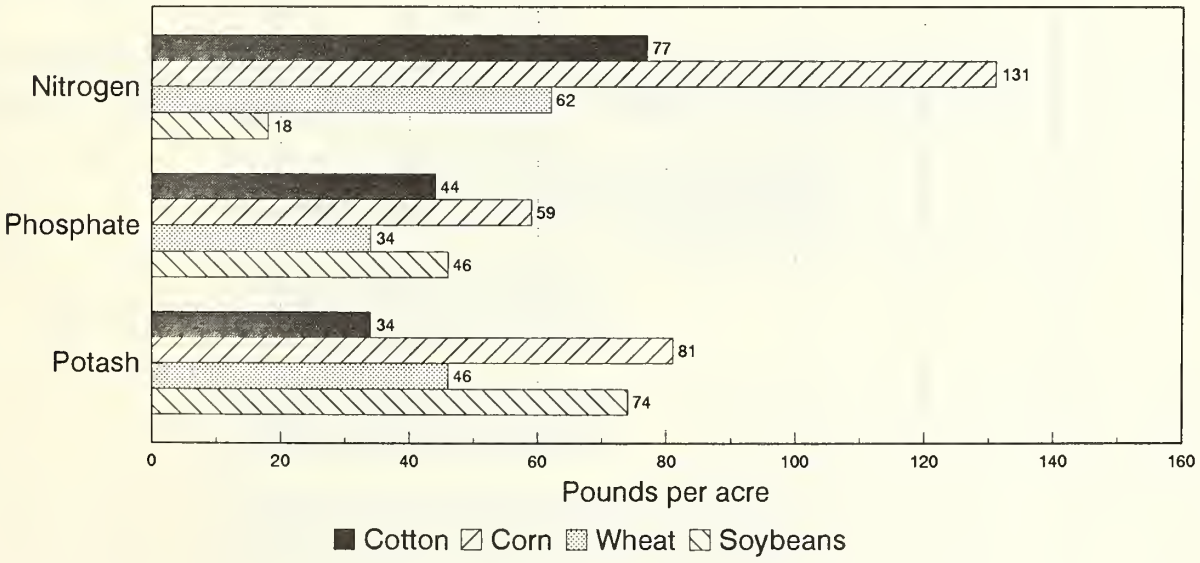


Figure 3

Cotton fertilization compared with other major U.S. field crops, 1989

Cotton production uses all three fertilizers shown less intensively than does corn production.



Cotton data are from the survey. Wheat, corn, and soybean data are from Agricultural Resources: Inputs. Situation and Outlook Report, February 1990.

Herbicide Use

Cotton producers use a variety of methods and treatments to control weeds. The West is slightly less reliant on chemical weed control than the other three cotton production regions surveyed.

Herbicides are extensively used in cotton production to fight weeds. Weeds reduce yield by competing with cotton plants for available light, moisture, and nutrients. Weeds also can reduce the quality and marketability of cotton lint (for instance, grasses can stain the lint during harvest). The bedded land is usually tilled before planting to reduce grass and weed infestation. Both pre- and post-emergence herbicides are applied.

Herbicides are used extensively throughout the cotton-producing States. Of the 39 herbicide products reported in the survey, the most widely used was trifluralin, used on 64 percent of surveyed acres. Other popular products are fluometuron, (31 percent), pendimethalin, (21 percent), MSMA (21 percent), norflurazon, (19 percent), prometryn, (16 percent), cyanazine (15 percent), and glyphosate (14 percent) (table 2).

Nearly 100 percent of the 1989 planted cotton acreage in the Southeast, Delta, and Southern Plains was treated with herbicides. Cotton producers in the West are somewhat less reliant on chemical weed control. The percentage of cotton acres treated there is 82 percent (fig. 4).

Weed control in cotton can be complex and require multiple treatments. Cotton producers face a number of different target weed species, and the severity of the control problem varies considerably depending on environmental conditions in different regions. Of the surveyed acreage, 4.4 million acres (43 percent) received one herbicide treatment and 5 million acres (49 percent) received more than one herbicide treatment.

Treatments are often spread out over the season. Early season weed control is important to allow the plant to become established. Late season weed control is important to maintain crop yield and quality. Slightly more than two treatments per acre were reported for the surveyed regions taken as a whole (fig. 5). An estimated 628,000 acres (14 percent) had five treatments.

Table 2--Herbicide use on cotton acreage, 1989

Trifluralin was the most widely used herbicide of the 39 reported in the survey.

Chemical	Share of acres treated	Average treatment per acre	Application rate
	Percent	*Number*	*Lbs/acre*
Trifluralin	63.7	1.1	0.93
Fluometuron	31.3	1.1	1.82
Pendimethalin	20.9	1.0	1.02
MSMA	20.7	1.1	2.55
Norflurazon	18.9	1.2	1.78
Prometryn	16.1	1.1	1.04
Cyanazine	15.3	1.1	1.13
Glyphosate	14.3	1.0	1.21
Fluazifop-butyl	7.5	1.0	.19
DSMA	7.0	1.0	2.48
Methazole	5.5	1.0	.84
Metolachlor	3.2	1.0	1.68
Direx	2.7	1.0	.95
Sethoxydim	1.0	1.0	.26

Note: Herbicides used on less than 1 percent of sampled acreage were not listed.

Figure 4

Acreage treated with herbicides by region, 1989

The West was slightly less reliant on chemical weed control than other regions.

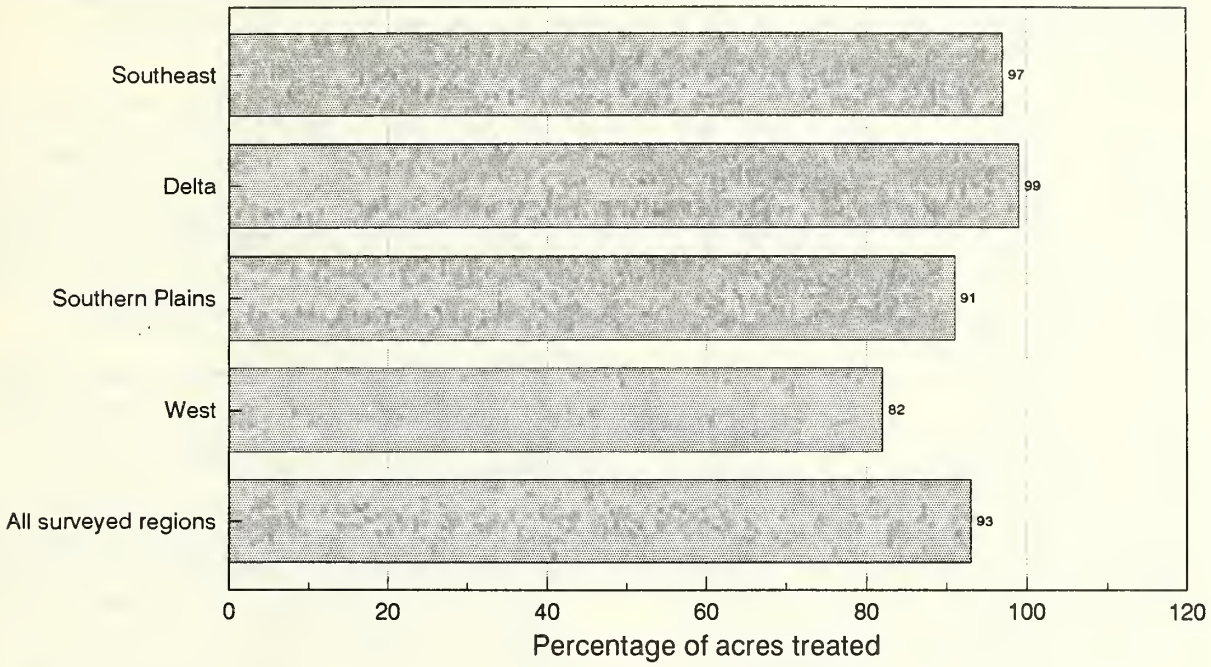
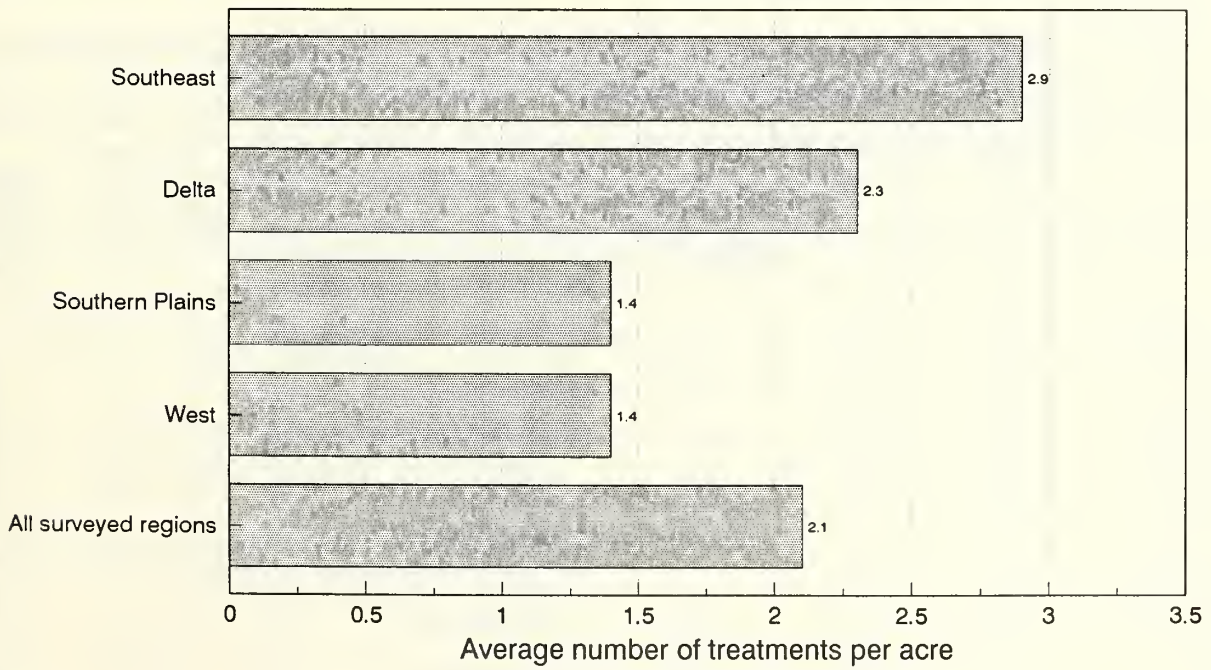


Figure 5

Number of cotton herbicide treatments by region, 1989

Slightly more than two treatments per acre were reported for the surveyed regions as a whole.



Insecticide Use

Cotton producers applied nearly 18 million pounds of insecticides to control a variety of pests. The Delta and the Southeast were the heaviest users of insecticides, reflecting the severity of the insect pest problem there.

Cotton farmers are faced with several insect pests, including the boll weevil, pink bollworm, bollworm, cotton aphid, and the tobacco budworm. Insect problems are the greatest in the Delta and Southeast, and the least in the Southern Plains. The severity of the insect control problem varies with a number of factors, including the amount of rainfall, irrigation levels, and crop rotation patterns.

Surveyed cotton producers reported using insecticides on 7.1 million acres (68 percent of the 10.5 million acres surveyed) (fig. 6). The number of treatments averaged 4.7 per acre for the four regions, ranging from a high of 10.8 treatments in the Southeast to a low of 2.5 treatments in the Southern Plains (fig. 7). The Delta and the Southeast were the heaviest users of insecticides, reflecting the severity of their pest problems. Over 70 percent of the surveyed acreage there had five treatments or more (fig. 7).

Although a wide variety of chemicals are used, not all insecticides affect water quality in the same way. Different chemicals have varying propensities to leach to ground water or run off to surface water via soil erosion. Effects of insecticide use on water quality also depend on soil conditions and will vary regionally.

Cotton farmers use many different chemical insecticides. The most popular pesticides were methyl parathion (used on 25 percent of surveyed acres), cypermethrin (20 percent), aldicarb (16 percent), dicrotophos (14 percent), and esfenvalerate (13 percent) (table 3). Malathion was the most heavily used insecticide (in terms of total pounds of active ingredient applied), with 3.8 million pounds applied primarily to control boll weevils that could over-winter. Insecticide application rates were highest in the Southeast, with over 6 pounds of active ingredient applied per acre, partly due to the boll weevil eradication program in Georgia and Alabama.

Table 3--Insecticide use on cotton acreage, 1989

Cotton farmers use many different chemical insecticides, but not all of the chemicals affect water quality the same way.

Chemical	Share of acres treated	Average treatment per acre	Application rate	Chemical	Share of acres treated	Average treatment per acre	Application rate
	Percent	*Number*	*Lbs/acre*		*Percent*	*Number*	*Lbs/acre*
Methyl parathion	24.6	2.9	1.78	Chlorpyrifos	4.5	2.7	.74
Cypermethrin	20.3	2.0	.17	Tralomethrin	4.4	1.7	.04
Aldicarb	15.6	1.0	.75	Chlordimeform	4.2	3.1	.54
Dicrotophos	13.6	1.9	.38	Oxamyl	3.5	1.5	.36
Esfenvalerate	13.1	2.5	.12	Propargite	3.5	1.5	1.97
Azinphosmethyl	11.8	2.2	.62	Methomyl	3.3	1.3	.41
Cyfluthrin	10.2	1.9	.08	Permethrin	2.9	1.7	.22
Dimethoate	7.6	1.4	.36	Methamidaphos	2.3	1.1	.64
Lamdacyhalothrin	7.2	2.1	.07	Sulprofos	1.9	1.1	1.00
Acephate	6.8	1.5	.71	Monocrotophos	1.9	1.2	1.15
Profenfos	5.7	1.3	1.30	Fenvalerate	1.8	1.5	.21
Thiodicarb	5.2	1.9	.93	Ethyl parathion	1.4	2.5	2.34
Dicofol	4.8	1.1	1.04	Bifenthrin	1.2	1.1	.08
Malathion	4.6	2.3	8.16	Flucythrinate	1.1	4.0	.17

Note: Insecticides used on less than 1 percent of sampled acreage were not listed.

Figure 6

Acreage treated with insecticides by region, 1989

Surveyed cotton farmers reported using insecticides on 68 percent of the 10.5 million acres surveyed.

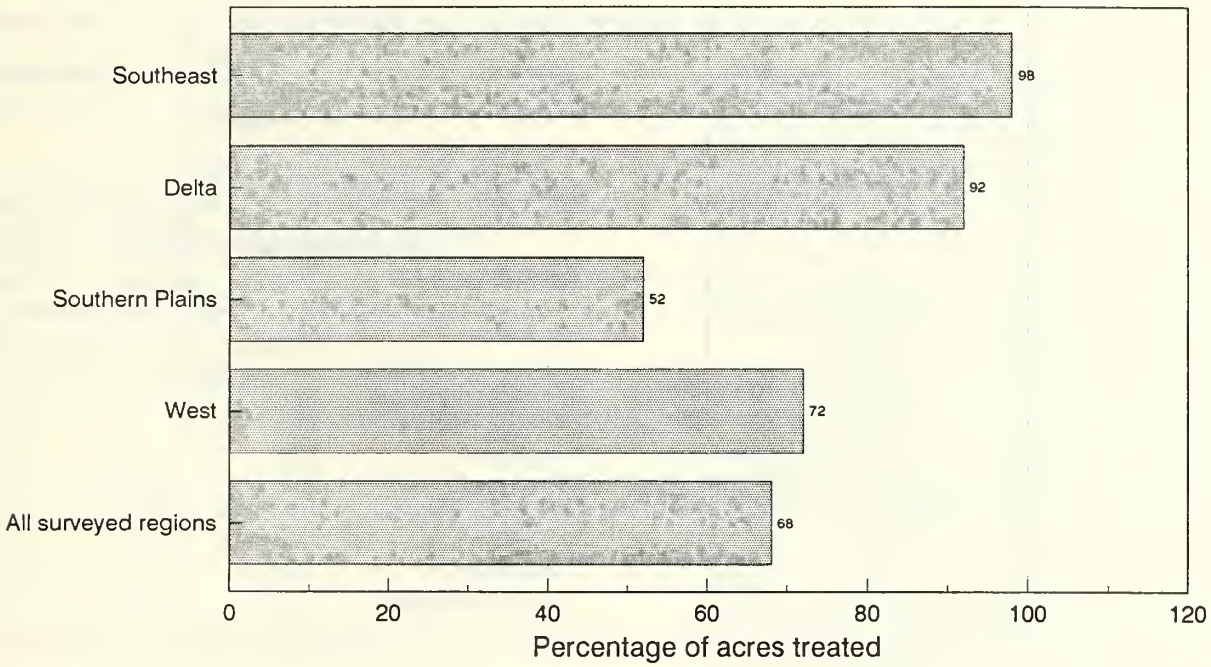
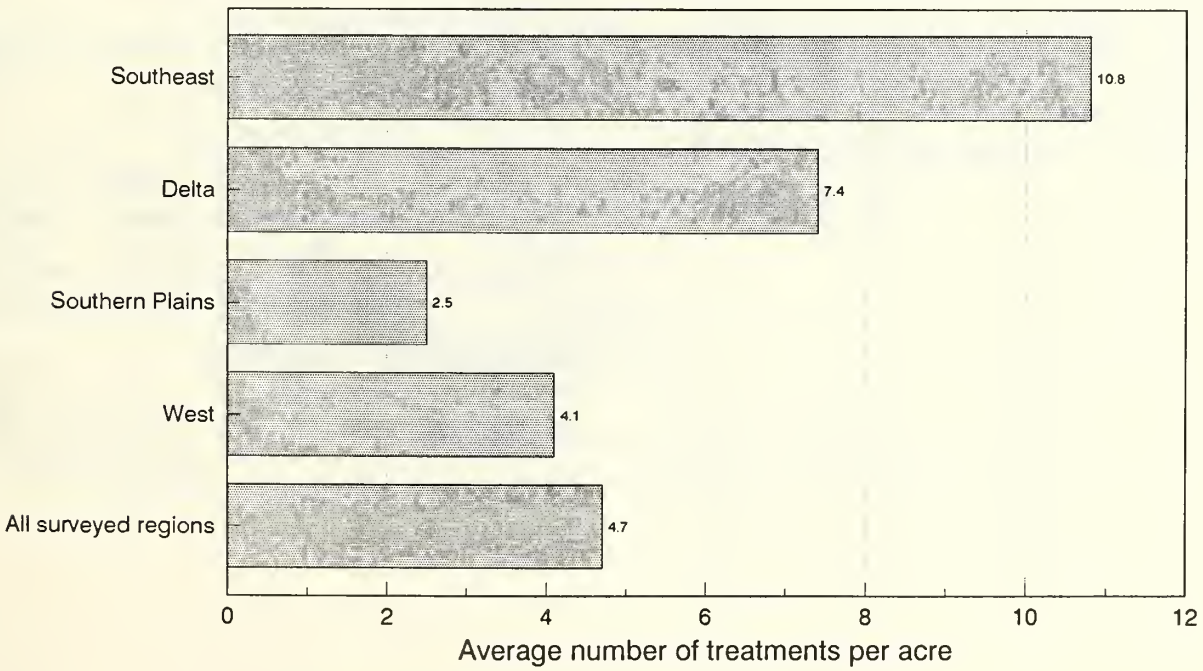


Figure 7

Number of cotton insecticide treatments by region, 1989

*The Southeast had the most insecticide treatments per acre, and the Southern Plains the least.**



*The Southeast's heavy use of insecticides reflects the severity of the pest problem there, exacerbated by a warm climate in which pests can over-winter.

Other Chemical Use

Growth regulators, desiccants, defoliants, and fungicides are used less frequently on cotton than are fertilizers, insecticides, or herbicides. Fungicides are used least.

Cotton farmers use agrichemicals for a variety of purposes other than fertilizing and controlling weeds and insects. Chief among them are controlling disease, controlling unwanted foliage, and regulating growth of plants for evenness and ease of harvest.

Cotton farmers appiied defoliants and desiccants to 5.1 million acres in 1989. Defoliants and desiccants are applied to cotton plants to aid the harvesting process as the bolls on the plants mature. Phosphorotrihoate is the most frequently used defoliant, applied to about 35 percent of all cotton acreage (table 4). The West accounted for the highest proportion of acreage treated (96 percent) and the Southern Plains the least (16 percent) (fig. 8).

Growth control chemicals were used on 3.7 million acres in 1989. Two types of growth regulators are applied to cotton farmland: mepiquat chloride (25 percent of surveyed acreage) and ethephon (19 percent) (table 4). About 1.5 acre treatments per season were recorded for the survey as a whole. The Southeast region accounted for the highest proportion of acreage treated: 64 percent.

Fungicides are not widely used to produce cotton. Of the surveyed acreage, only about 819,000 acres (8 percent) were treated with fungicides. Of the acres that were treated, one treatment was used (fig. 9). Other disease control measures used include cultivation practices, chemical seed treatment, and fumigation.

Table 4--Other agrichemical use on cotton acreage, 1989

Cotton farmers use few fungicides.

Chemical	Share of acres treated	Average treatment per acre	Application rate
	Percent	*Number*	*Lbs/acre*
Desiccants/defoliants:			
Phosphorotrihoate	35.1	1.1	1.10
Sodium chlorate	11.3	1.1	5.02
Paraquat	10.4	1.0	.16
Thidiazuron	10.3	1.1	.25
Endothall	4.2	1.0	.09
Arsenic acid	3.1	1.0	1.96
Dimethipin	2.8	1.0	.30
Sodium cacodylate	2.1	1.0	.78

Chemical	Share of acres treated	Average treatment per acre	Application rate
	Percent	*Number*	*Lbs/acre*
Fungicides:			
Etridiazole	2.6	1.0	1.35
Etridiazole + disulfoton	2.0	1.0	1.39
PCNB	1.7	1.0	.68
Metalaxyl	1.1	1.0	.36

Chemical	Share of acres treated	Average treatment per acre	Application rate
	Percent	*Number*	*Lbs/acre*
Growth regulators:			
Mepiquat chloride	24.9	1.5	0.03
Ethephon	18.9	1.0	1.07

Note: Chemicals used on less than 1 percent of sampled acreage were not listed.

Figure 8

Acreage treated with other agrichemicals by region, 1989

The West accounted for the highest proportion of acreage treated, and the Southern Plains the least.

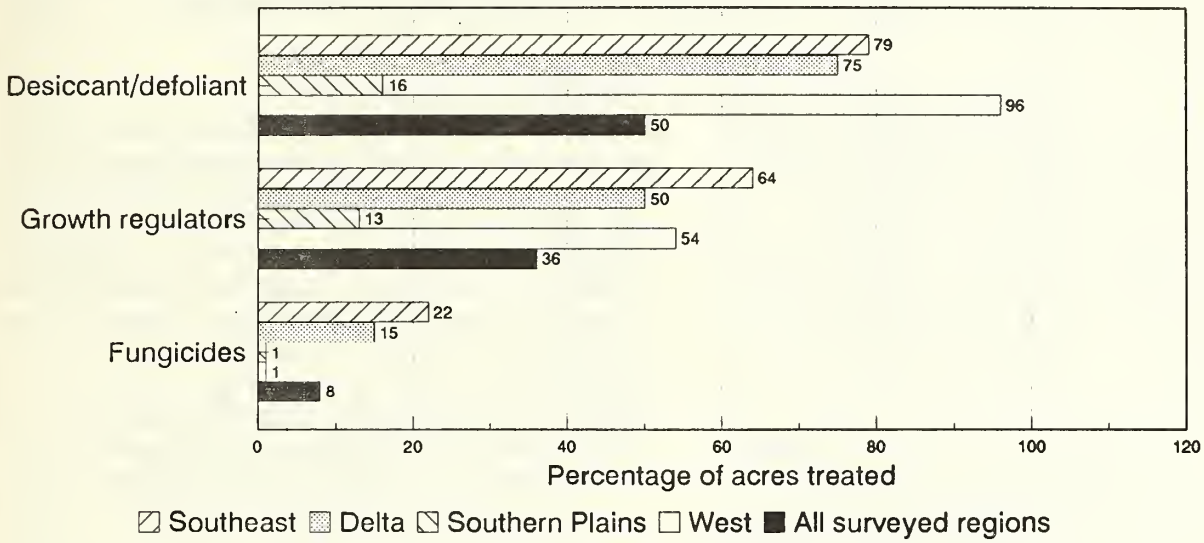
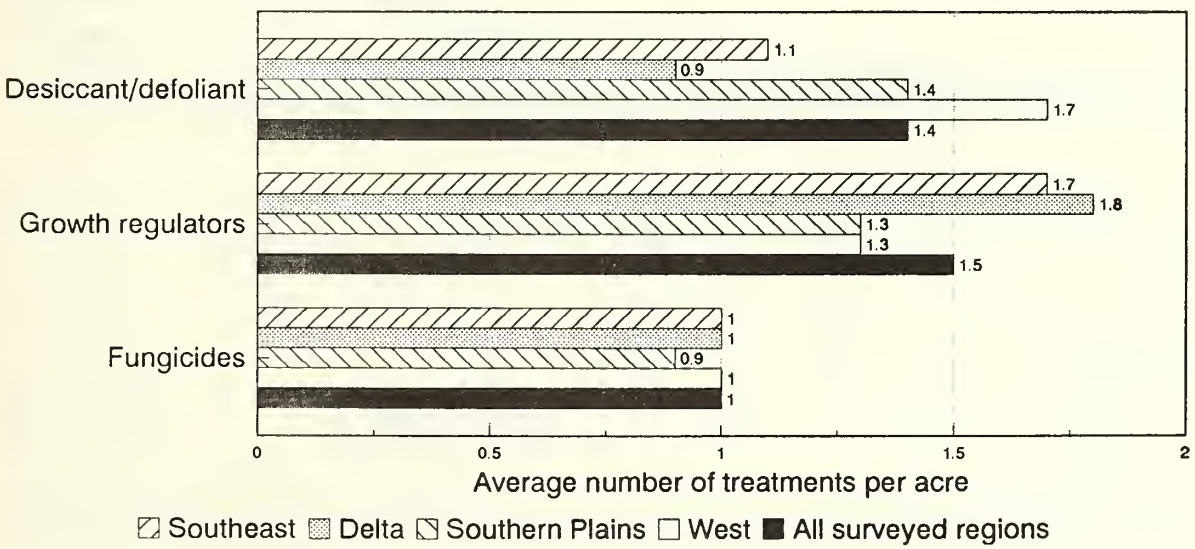


Figure 9

Number of other agrichemical treatments of cotton by region, 1989

One treatment of fungicide per acre was used for the surveyed regions as a whole.



Pest Management Programs

Cotton producers also use nonchemical cultural and biological practices to control pests. Cultivation and stalk destruction were the most widely used practices in all regions, while scouting was most intensively used in the West.

A variety of cultural practices are available to cotton farmers to reduce pest damage. These approaches can complement insecticide use or can be used to reduce agrichemical inputs. Examples of these practices include reducing sources of insect food and shelter, controlling the rate of pest population growth, or concentrating pests in small areas where direct control measures can be applied without disrupting beneficial species.

Cultivation and stalk destruction were the most widely used nonchemical pest management strategies in 1989. Cultivation was used on 97 percent of cotton acres surveyed and stalk destruction was used on 74 percent. Some areas require stalk destruction by law.

According to the survey, other practices include planting resistant varieties (40 percent of planted acres), using pheromone traps (34 percent), and employing diapause control (21 percent) (table 5). Some producers used commercial scouting systems as part of pest management, which allow producers to target insecticide applications based on pest population levels. In three of the four regions, more than half of the planted cotton acreage was in scouting programs in 1989. Scouting was most intensively used in the West, with an average of 25 scouting trips during the cotton growing season.

Table 5--Nonchemical pest management practices

Cultivation and stalk destruction were the two most commonly used practices, but scouting is becoming popular.

Item	Southeast	Delta	Southern Plains	West	All surveyed regions
			Percentage of cotton acres		
Cultivation	98	97	97	92	97
Stalk destruction	96	85	58	98	74
Resistant varieties	74	38	29	70	40
Pheromone traps	78	39	9	90	34
Diapause control	64	25	10	26	21
Boll weevil eradication	40	0	0	17	6
Acreage in scouting programs	57	70	44	73	56
			Trips per acre		
Scouting trips	17	22	12	25	18

Irrigation Use

Forty percent of all cotton acres were irrigated in 1989. The proportion of cotton acreage that was irrigated in the Southeast was 11 percent, while it was 100 percent in the West.

The importance of irrigation in cotton production has increased recently. In 1974, 30 percent of cotton acreage was irrigated, increasing to 37 percent in 1978 and to 43 percent in 1989. This trend is largely a consequence of the westward shift of cotton acreage. Only 11 percent of all surveyed acreage in the Southeast was irrigated in 1989, but every surveyed cotton acre in the West was irrigated (table 6).

Much of the irrigated cotton acres water was obtained from underground sources, particularly in the Plains States. In the Southern Plains, which accounted for half of the irrigated cotton acreage, 89 percent of the irrigation water comes from wells. Average rates of water application also varied by region, from 3.7 inches per acre in the Southeast to nearly 40 inches per acre in the West.

Cotton producers may be shifting to newer irrigation technologies. Increasing reliance on irrigation raises questions about both water quality and quantity. High levels of irrigation in California have been cited as reasons for rising water tables and increasing problems of higher salinity in the soil and in irrigation return flows. Draw-down of ground water supplies in the Plains States and the West from irrigation has led to increased emphasis on increasing the efficiency of irrigation.

Gravity application systems, normally considered the most inefficient irrigation systems from a technical perspective, were used on over 60 percent of cotton acreage in the Southern Plains and 90 percent of cotton acreage in the West. Because of growing demands for water, however, some gravity systems are being replaced by more efficient sprinkler systems.

Chemigation, a newer technology that mixes nutrients and pesticides in irrigation water, is being used on 38 percent of cotton acreage in the West.

Table 6--Cotton irrigation by region, 1989

Every surveyed cotton acre in the West was irrigated.

Item	Unit	Southeast	Delta	Southern Plains	West	All surveyed regions
Acres irrigated	Percent of surveyed acreage	11	29	43	100	43
Cotton water use:						
Amount applied	1,000 acre feet	32	681	3,159	4,229	8,101
Application rate	Inches/acre	3.7	9.4	17.9	39.4	--

-- = Not applicable.

Soil Conservation Practices and Soil Erosion

Conventional tillage predominates in cotton production. Of the soil conservation practices being used, terracing, employing grass waterways, and contour plowing are the most common.

Soil conservation is an important part of efforts to reduce agriculture's effect on surface water quality. Reducing soil erosion by such practices as conservation tillage, contour plowing, and grass waterways reduces delivery of sediment and farm chemicals to nearby lakes and streams.

Most cotton farmers use conventional tillage. There is little use of erosion control practices in the West because, with its dry climate and mostly loam or clay soil, it is less erosion prone.

Conservation tillage was used on 9 percent of surveyed acreage (table 7). Other erosion control practices are somewhat more prevalent, but none is in widespread use. Stalk destruction eliminates residue on cotton fields (leaving residue on the field is a common erosion control measure).

Soil characteristics of cotton farms can be important factors in assessing agriculture's effect on water quality. Soil type and slope are two factors that affect the potential for water-based soil erosion. Cotton in the Delta, Southern Plains, and West was found to be produced primarily on loams or clays and fields were relatively level. In the Southeast, however, a relatively higher proportion of soils were either sandy or had slopes greater than 2 percent. These lands are more erosion prone and production there may have an adverse effect on adjacent surface water bodies by increasing sediment and agrichemicals in runoff.

Table 7--Soil characteristics and soil conservation practices by region, 1989

Terracing is used in three of the four regions.

Item	Southeast	Delta	Southern Plains	West	All surveyed regions
			Percentage of cotton acres		
Erosion control practices:					
Conservation tillage	7	5	13	4	9
Terraces	23	8	27	--	18
Contour	13	4	21	11	13
Strip cropping	--	3	11	--	6
Grass waterways	22	22	--	--	13
Soil type:					
Sand	33	2	12	1	10
Loam	59	77	49	43	57
Clay	8	21	39	56	33
Over 2 percent slope	71	22	30	9	28

-- = less than 0.5 percent of surveyed acreage.

Proximity to Water and Other Resource Characteristics

Cotton production near wells or surface water bodies may increase the potential for farm chemicals to affect water quality.

An important factor in determining agriculture's effect on water quality is the distance from the field to either a well or a surface water body. If a well is contained within a surveyed field or is found nearby and if cropland lies over a shallow aquifer, a potential for fertilizers and pesticides to leach into ground water supplies may exist. Similarly, if farming takes place near a lake or a stream, the likelihood that runoff from cropland due to soil erosion will degrade surface water quality also increases.

Nearly 60 percent of the total cotton acreage surveyed contained a well of some type somewhere on the farm (table 8). About 75 percent of the fields surveyed were within a half mile of a well of some type. Twenty three percent of the acreage was within 1 mile of a river or stream and 15 percent was within 1 mile of a pond or a natural lake.

Important questions remain about well-water quality in cotton-producing areas. Survey respondents were asked whether the well nearest to the surveyed field had been tested for nitrates or pesticide residues. For 96 percent of the surveyed acreage, either the well in question had not been tested or the respondents did not know whether testing had been done. Only 4 percent of the acreage contained a well or was near a well that recently had been tested. The survey was not designed specifically to determine producer awareness of potential well water quality problems. Much more research and monitoring is necessary to determine the extent of any ground water quality problem related to cotton production.

Table 8--Cotton land's proximity to water and other resource chacteristics by region, 1989

Nearly 60 percent of all cotton acres surveyed had a well somewhere on the farm.

Item	Southeast	Delta	Southern Plains	West	All surveyed regions
			Percentage of cotton acres		
Acreage containing a well	44	51	61	83	60
Distance to water bodies:					
Acreage within 1 mile of--					
Lake or pond	11	17	18	1	15
River or stream	42	53	6	7	23
City or public well	4	9	2	1	4
Water characteristics:					
Acreage where nearby well has been tested for nitrates or pesticides	1	2	5	7	4

Characteristics of Cotton Enterprises and Producers

Cotton farms tend to be larger than other farms. Cotton producers, generally younger and better educated than the average U.S. producer, may make them more receptive to new technologies and new programs to protect water quality.

Compared with all U.S. farms, cotton farms tend to be large. Sixty percent of the planted cotton acreage in 1989 was on farms of 1,000 acres or more. Nearly 75 percent of the cotton was grown on farms having total sales over $100,000, and nearly 20 percent on farms having total sales over $500,000 (table 9).

Cotton production is especially concentrated on large farms in the West. There, farms with sales of $500,000 or more accounted for nearly 69 percent of the cotton acreage in the region. In contrast, the largest farms in the Southern Plains accounted for only 5 percent of that region's cotton acreage. Participation in the cotton program was lowest in the West (75 percent by acreage), compared with 90 percent or greater in the other three regions.

Cotton farmers are younger and have more education than the average for the United States. Almost 60 percent of the cotton acreage is farmed by farmers who are under 50 years old, while only 9 percent is farmed by farmers who are 65 years or older. Comparable figures for all U.S. farmers are 43 percent and 21 percent, respectively. Over 50 percent of the cotton acreage is operated by farmers who have some education beyond high school. Nearly 30 percent of the acreage is operated by farmers who have completed college or graduate school.

Younger and more highly educated farmers are generally believed to be more receptive to new technology. The characteristics of the U.S. cotton farmers surveyed in 1989 indicate that new technologies or farming systems to protect water quality or conserve water resources may find acceptance in the cotton sector.

Table 9--Characteristics of cotton operations by region, 1989

Cotton production is heavily concentrated in large owner-operated farms with high sales in the West.

Characteristic	Unit	Southeast	Delta	Southern Plains	West	All surveyed regions
Area planted	Thousand acres	852.0	2,974.0	5,041.0	1,290.0	10,157.0
Mean yield	Bales/acre	1.3	1.3	.8	2.6	1.2
Average value of cotton land	Dol./acre	1,187.6	867.8	576.9	2,447.1	950.8
Farm size class:	Pct. of cotton acres					
Less than 250 acres	do.	3.3	4.6	5.6	4.1	4.9
251-500 acres	do.	9.0	7.7	7.0	10.2	7.8
501-1,000 acres	do.	28.2	28.6	28.2	19.4	27.2
1,001-2,000 acres	do.	34.6	30.6	35.4	19.7	31.9
Over 2,000 acres	do.	25.0	28.5	23.8	46.5	28.2
Gross farm sales class:						
Under $40,000	do.	4.2	6.7	11.5	2.3	8.3
$40,000-$99,999	do.	13.0	12.3	23.2	7.1	17.1
$100,000-$249,999	do.	38.4	26.9	44.4	10.4	34.4
$250,000-$499,999	do.	24.6	33.3	16.1	11.7	21.3
$500,000 or more	do.	19.9	20.9	4.9	68.5	18.9
Operator age class:						
Under 35	do.	19.8	21.7	15.2	16.7	17.7
35-49	do.	43.7	45.7	39.7	39.7	41.8
50-64	do.	35.0	28.7	31.7	33.9	31.4
65 and older	do.	1.5	3.9	13.4	9.7	9.1
Education:						
Less than high school	do.	7.7	8.3	13.6	6.2	10.6
Completed high school	do.	48.7	35.0	34.2	20.2	33.9
Some college	do.	25.5	25.6	26.9	27.9	26.6
Completed college	do.	18.1	25.2	19.9	29.1	22.5
Graduate school	do.	0	5.8	5.5	16.5	6.5
Farm program participation:						
Cotton program	do.	94.7	94.4	92.5	74.7	91.0
Federal crop insurance	do.	38.3	16.8	55.9	8.6	36.9
Land tenure:						
Owner operated	do.	65.0	53.5	43.8	72.1	52.0
Tenant operated	do.	34.9	46.6	56.2	27.9	48.0

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For More Information.....

This report is intended to provide an overview of the types of information collected in the 1989 Cotton Water Quality Survey. More detailed analyses are underway within the Economic Research Service, and results will be released as studies are completed.

For more information about the Cotton Water Quality Survey, please contact Stephen Crutchfield at (202) 219-0444. For information on other surveys and data collection efforts planned as part of USDA's contribution to the President's Water Quality Initiative, contact Dave Ervin (202) 219-0401.

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